

# PATENT ABSTRACTS OF JAPAN

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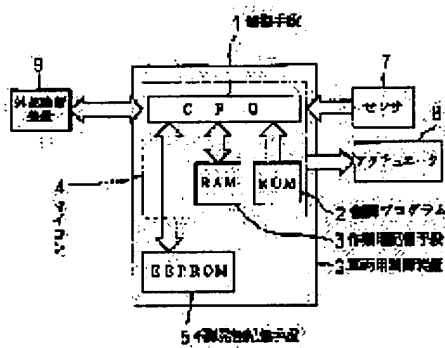
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## (54) CONTROL SYSTEM FOR VEHICLE

(57)Abstract:

PURPOSE: To read out a program or a datum which is low in the frequency of use among the stored contents of a serial communication system nonvolatile memory means when a special condition is satisfied, and to transfer it to a work memory means.

CONSTITUTION: The memory area of a serial communication system EEPROM 5 arranged in ECU 6 for executing the engine control of an automobile is separately composed of the first area where a failure diagnosis program and judged value data are stored, in which the failure diagnosis program is usually executed after the start of an engine and the second area where a data outputting program is stored, which is used only in the case of an external diagnosis device 9 connected to ECU 6. CPU 1 first transfers the stored contents of the first area to RAM 3, and the stored contents of the second area are read out when the external diagnosis device 9 is connected to ECU 6 and transferred to RAM 3.



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**CLAIMS**

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[Claim(s)]

[Claim 1] A control program storage means by which a control program is memorized, and a working-level month storage means by which a program or data is transmitted at the time of an activity, While performing the control program read from the non-volatile storage means and control program storage means of the serial communication method with which the auxiliary programs or data other than a control program are memorized The auxiliary program or data read from said non-volatile storage means is transmitted to said working-level month storage means.

In the control unit for cars which possesses the control means which reads and performs an auxiliary program or data from a working-level month storage means henceforth if needed said non-volatile storage means The 1st area where the high auxiliary program or the data of operating frequency is memorized, It classifies and memorizes in the 2nd area where the low auxiliary program or the data of operating frequency is memorized. Said control means The control unit for cars characterized by transmitting the contents of storage of the 1st area to said working-level month storage means previously, and transmitting the contents of storage of the 2nd area to a working-level month storage means when special requirements are materialized.

[Claim 2] A control means is a control unit for cars according to claim 1 characterized by being constituted so that the termination of a transfer of the contents of storage of the 2nd area, interruption, or activation of the contents of storage may be chosen according to the contents of the processing command in special requirements.

[Claim 3] The auxiliary program or data memorized by the non-volatile storage means is a control unit for cars according to claim 1 or 2 characterized by being the program or data about troubleshooting of a car.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Industrial Application] When a program is read from a storage means at the time of program execution, this invention transmits the program to the working-level month storage means in which rapid access is possible, and relates to the control unit for cars which reads subsequent programs from a working-level month storage means, and performs them.

[0002]

[Description of the Prior Art] In the car, for example, an automobile, the engine control is performed by the control device containing a microcomputer, and the engine control program is

memorized by storage means, such as ROM.

[0003] Moreover, in an automobile, there is a thing with EEPROM used for the interior of a control unit as an auxiliary storage means. In order that this EEPROM may lessen the number of wiring, many things of the serial communication method which the address and data are synchronized with a clock signal, and transmits and receives them 1 bit at a time are used.

[0004]

[Problem(s) to be Solved by the Invention] By the way, in this way, when using the serial communication method EEPROM as an object for automobiles, it is assumed that the judgment data used for the electric fault finding about an engine or its troubleshooting are memorized. In this case, after a control program is read from the problem of the read time of EEPROM at the time of engine starting, from EEPROM, electric fault finding and judgment data are read serially, and are transmitted to RAM with a quick access speed. And the electric fault finding transmitted to RAM is read, a diagnosis of each part of an automobile is performed, and, as a result, it is displayed on the panel of a driver's seat by CPU of a microcomputer at the time of failure generating, and is reported to an operator.

[0005] It seems that moreover, the more detailed data of the troubleshooting result which the control unit performed may be displayed on external diagnostic equipment by connecting external diagnostic equipment to a control unit in troubleshooting of an automobile. Therefore, when external diagnostic equipment is connected to EEPROM, it is also assumed that the program for data output for outputting troubleshooting data is also memorized, and at the time of engine starting, with electric fault finding etc., these will also be read from EEPROM and will be transmitted to RAM.

[0006] However, EEPROM of a serial communication method transmits the address and 1 bit of data at a time by clock synchronization as mentioned above, and the read-out takes time amount very much to it. Moreover, the opportunity for external diagnostic equipment to be connected to a control device is the routine inspection time etc., and is rare, and reading the program for data output and data for it over [ EEPROM ] many hours each time, and transmitting to RAM had the fault to which it becomes an excessive processing burden and the processing time becomes long for the control device.

[0007] This invention solves the above-mentioned technical problem, the purpose is the contents of storage of a secondary memory means slack non-volatile storage means, and offering the control unit for cars controlled to carry out only when special requirements are materialized has the transfer to the working-level month storage means of the low auxiliary program or data of operating frequency.

[0008]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the control unit for cars according to claim 1 A control program storage means by which a control program is memorized, and a working-level month storage means by which a program or data is transmitted at the time of an activity, While performing the control program read from the non-volatile storage means and control program storage means of the serial communication method with which the auxiliary programs or data other than a control program are memorized In what transmitted the auxiliary program or data read from the non-volatile storage means to the working-level month storage means, and possesses the control means which reads and performs an auxiliary program or data from a working-level month storage means henceforth if needed The 1st area where, as for a non-volatile storage means, the high auxiliary program or the data of operating frequency is memorized, It classifies and memorizes in the 2nd area where the low

auxiliary program or the data of operating frequency is memorized. A control means When the contents of storage of the 1st area are previously transmitted to a working-level month storage means and special requirements are materialized, it is characterized by transmitting the contents of storage of the 2nd area to a working-level month storage means.

[0009] The control unit for cars according to claim 2 has the description at the place which constitutes a control means so that the termination of a transfer of the contents of storage of the 2nd area, interruption, or activation of the contents of storage may be chosen according to the contents of the processing command in special requirements.

[0010] In this case, the auxiliary program or data memorized by the non-volatile storage means is good to consider as the program or data about troubleshooting of a car (claim 3).

[0011]

[Function] According to the control unit for cars according to claim 1, since a control means transmits previously the contents of storage of the 1st area where operating frequency is higher than a non-volatile storage means to a working-level month storage means, and they are read when special requirements are materialized, and it transmits them to a working-level month storage means about the contents of storage of the 2nd area where operating frequency is low, unnecessary read-out and transfer processing are not performed.

[0012] According to the control unit for cars according to claim 2, even when special requirements are materialized, according to the contents of the processing command in the special requirement, the transfer to the working-level month storage means of the contents of storage of the 2nd area is stopped, or it is interrupted or the contents of storage of the 2nd area are performed.

[0013] In this case, from the exterior, about processing of troubleshooting, the contents of storage of the 2nd area used by the program about troubleshooting or the data, then the low frequency of a car are read, only when required, and the auxiliary program or data memorized by the non-volatile storage means is transmitted to a working-level month storage means (claim 3).

[0014]

[Example] This invention is explained with reference to a drawing below about one example at the time of applying to the troubleshooting processing in engine control of the automobile which is a car. In drawing 1 which shows the electric configuration of the part concerning this invention, CPU1 which is a control means is connected to RAM3 which is ROM2 and the working-level month storage means which are a control program storage means through the control signal line at the address and the data bus line list of parallel. The above constitutes the microcomputer (a microcomputer is called below) 4.

[0015] Moreover, there is EEPROM5 of the serial communication method which is a non-volatile storage means in the exterior of a microcomputer 4, and EEPROM5 is connected with CPU1 by serial bus through the serial interface which is not illustrated. And the engine control (ECU is only called hereafter) ECU 6 which controls the engine which is not illustrated as a control device for cars by the microcomputer 4 and EEPROM5 is constituted.

[0016] Moreover, it connects with CPU1 through the A/D converter which the sensor 7 containing a coolant temperature sensor, an intake temperature sensor, a throttle sensor, etc. does not illustrate, and the actuators 8, such as an injector and an idle speed control (ISC) bulb, are connected through the output circuit which is not illustrated. Furthermore, to ECU6 (CPU1), the external diagnostic equipment 9 is connectable by serial bus through the serial interface which is not illustrated, and CPU1 can be detected now with the detection signal with which the switch for connection detection which is not illustrated outputs whether whether special requirements'

being materialized and the external diagnostic equipment 9 are connected.

[0017] In drawing 2 which shows the address map of EEPROM5, it is the 1st area, for example, decision value data, such as opening / short decision value of the coolant temperature sensor as an auxiliary data, opening / short decision value of an intake temperature sensor, and an abnormality decision value in an ISC bulb, are stored the head of an address field to the first half. Moreover, although neither carries out illustration, diagnostic programs which perform troubleshooting using these decision value data, such as a coolant temperature sensor as an auxiliary program, an intake temperature sensor, and an ISC bulb, are also stored. The operating frequency of the diagnostic program and decision value data which are memorized in such 1st area used each time at the time of engine actuation is high.

[0018] It is the 2nd area after the 1st area, and the auxiliary program used since troubleshooting data are outputted to the external diagnostic equipment 9, for example, a coolant temperature sensor, the intake temperature sensor, the program for an ISC bulb diagnostic-data output, etc. are stored. The program for an output memorized in such 2nd area is used only when the external diagnostic equipment 9 is connected to ECU6, and the operating frequency is low.

[0019] Next, an operation of this example is explained also with reference to drawing 3 thru/or drawing 6. In drawing 3 which shows the flow chart of the contents of control in the initialization processing after reset discharge, CPU1 clears first the contents of storage of the field used as a working area of RAM3 zero times in the processing step P1 of "RAM initialization." All the flags that are used by CPU1 in the processing mentioned later as for this zero clearance, setting in software are also reset. And it shifts to the processing step P2 of the next "EEPROM read-out address (N) initialization", and start-address N of the field currently assigned to EEPROM5 on the address map of CPU1 is initialized to an address counter.

[0020] And it will shift to the processing step P3 of an "EEPROM read in demand flag set", and if "1" is written in the field of an EEPROM read in demand flag prepared in RAM3 and the demand flag is set, it shifts to the processing step P4 of the next "interrupt release", and the interrupt-inhibit condition automatically set as the status register of CPU1 by the power up will be canceled, and it will shift to the following step which is not illustrated.

[0021] Then, CPU1 performs engine starting and an engine roll control for a control program in read-out and the main routine which is not illustrated from ROM2. Moreover, it is constituted so that timer interruption may go into CPU1 every 8ms with the timer which is not illustrated.

Drawing 4 thru/or drawing 6 are the flow charts of the contents [ in / in all / the timer interruption processing ] of control.

[0022] In drawing 4 which shows the flow chart of the contents of control accompanying the connection condition of the external diagnostic equipment 9 in timer interruption processing, CPU1 judges first whether the external diagnostic equipment 9 is connected to ECU6 with reference to the detection signal of the connection detection switch which is not illustrated in the decision step Q1 of "external diagnostic-equipment connection ?." If the external diagnostic equipment 9 is not connected but it is judged as "NO" in the decision step Q1, it will shift to the processing shown in drawing 5 explained below. Moreover, if the external diagnostic equipment 9 is connected and it is judged as "YES" in the decision step Q1, it will shift to the following processing step Q2 of "transmitting a processing command Request-to-Send signal", and if a processing command Request-to-Send signal is transmitted to the external diagnostic equipment 9, it will shift to the processing shown in following drawing 5.

[0023] In drawing 5 which shows the flow chart of the program execution partial processing (activation partial processing is only called hereafter) memorized by EEPROM5 in timer

interruption processing, it is first judged in the decision step R1 of "1st area read in completion flag =1?" whether the 1st area read in completion flag which shows read in completion of the 1st area of EEPROM5 is "1." In an initial state, since 0 \*\*\*\*\* of all flags is carried out in step P1, it is judged as "NO", and it shifts to the processing shown in drawing 6 explained below.

[0024] In drawing 6 which shows the flow chart of read-out control-section processing (control-section processing is only called hereafter) of EEPROM5 in timer interruption processing, it is first judged in the processing step S1 of "EEPROM read in demand flag =1?" whether the EEPROM read in demand flag is set to "1." Here, since it is set to "1" in step P3, it is judged as "YES", and it shifts to the processing step S2 of the following "the address (N) to read-out", and is initialized in step P2, and the contents of storage of the start address of EEPROM5 (coolant temperature sensor opening / short decision value) which counted value N of an address counter shows are read through a serial bus. And it shifts to the processing step S3 of "transmitting to RAM."

[0025] In the processing step S3, the contents of storage of EEPROM5 read at step S2 are transmitted to the field to which it is assigned as a working area of RAM3. And it shifts to decision step S4 of "read in completion [ of the 1st area ] ?" of a degree, and the value and the counter value N which are set up as the last address of the 1st area of EEPROM5 are compared. At this time, by decision step S4, it is judged as "NO", and if it shifts to the processing step S5 of "N= N+1" and counted value N of an address counter is incremented, it will escape from timer interruption processing and it will carry out a return to the main routine which is not illustrated.

[0026] By [ into which timer interruption goes / the processing shown in drawing 4 thru/or drawing 6 so far ] being repeated every 8ms, the contents of storage of the 1st area of EEPROM5 are read from a head the single address every, and are transmitted to RAM3. And in step S5, the increment of the counted value N of an address counter is carried out, and it goes, and if it becomes equal to the value set up as the last address of the 1st area, in step S4, it will be judged as "YES", and will shift to the processing step S6 of the following "1st area read in completion flag set."

[0027] In the processing step S6, the 1st area read in completion flag which shows read in completion of the 1st area is set to "1", and it shifts to the decision step S7 of "read in completion [ of the 2nd area ] ?", and is compared with the value to which counted value N of an address counter is set as the last address of the 2nd area. At this time, at the decision step S7, it is judged as "NO", and if it shifts to the processing step S5 and counted value N of an address counter is incremented (counted value N becomes equal to the start address of the 2nd area at this time), it will escape from timer interruption processing and it will carry out a return to the main routine which is not illustrated.

[0028] Next, if timer interruption enters, since the read in completion flag of the 1st area is set to "1", it will be judged to be "YES" in step R1 of drawing 5 . And if it shifts to the decision step R2 of "external diagnostic-equipment connection ?", it will be judged whether the external diagnostic equipment 9 is connected to ECU6 (are special requirements materialized or not?). Here, supposing the external diagnostic equipment 9 is connected, in the decision step R2, it will be judged as "YES", and it will be judged whether it shifted to the decision step R3 of "processing command receiving [ from external diagnostic equipment ] ?" of a degree, and the processing command was received from the external diagnostic equipment 9.

[0029] In the decision step R3, if a processing command is not received from the external diagnostic equipment 9 but it is judged as "NO", it will escape from the activation partial processing shown in drawing 5 , and will shift to the control-section processing shown in

drawing 6 . In the decision step R3, if the processing command is received from the external diagnostic equipment 9 and it is judged as "YES", it will shift to the following decision step R4 of "whether a processing command is 1", and the contents of the processing command from the external diagnostic equipment 9 will judge "1" and no ("0"). In this case, the contents "1" of the processing command show the activation need for the contents of storage of the 2nd area, and the contents "0" show activation needlessness conversely. If it is judged as "YES" at this decision step R4, it will be judged whether the 2nd area read in completion flag which shifts to the decision step R5 of "2nd area read in completion flag =1?" of a degree, and shows read in completion of the 2nd area of EEPROM5 is set to "1." At this time, since the 2nd area of EEPROM5 is not read yet, it is judged to be "NO" in the decision step R5, escapes from the activation partial processing shown in drawing 5 , and shifts to the control-section processing shown in drawing 6 .

[0030] And in step S2 of drawing 6 , the contents of storage of the start address of the 2nd area of EEPROM5 which counted value N of an address counter shows at this time (head part of a coolant temperature sensor diagnostic-data output program) are read. And in the following step S3, the contents of storage are transmitted to RAM3 like the case of the 1st area.

[0031] In the following step S4, since it has completed, the read in of the 1st area judges it as "YES", and it repeats flag set actuation at step S6. In the following step S7, since it is judged as "NO" at this time, if counted value N is incremented at step S5, it will shift to the main routine which does not escape from and illustrate timer interruption processing.

[0032] By repeating the processing so far every 8ms containing timer interruption henceforth, like the case of the 1st area mentioned above, the contents of storage of the 2nd area of EEPROM5 are read from a head the single address every, and are transmitted to RAM3. And the increment of the counted value N is carried out in step S5, and it goes, and if it becomes equal to the value set up as the last address of the 2nd area, in step S7, it will be judged as "YES", and will shift to the processing step S8 of the following "2nd area read in completion flag set."

[0033] In the processing step S8, if the 2nd area read in completion flag which shows read in completion of the 2nd area is set to "1", it will shift to processing step S9 of the next "EEPROM read in demand flag reset", and if the EEPROM read in demand flag set to "1" in step P3 is set to "0" and reset, it will escape from timer interruption processing and a return will be carried out to a main routine. In the processing at the time of the timer interruption after this time, in order to judge it as "NO" in step S1, the control-section processing shown in drawing 6 after it escapes from and carries out the return of the interruption handling routine, without being carried out.

[0034] And in the next timer interruption processing, since the read in completion flag of the 2nd area is set, if it is judged as "YES" in step R4 of drawing 5 and shifts to step R5, it will be judged as "YES" here and will shift to the processing step R6 of the following "processing activation of the 1st and 2nd area."

[0035] In the processing step R6, the electric fault finding and decision value data of the 1st area of EEPROM5 which were transmitted to RAM3 are read, and the diagnostic program is performed to the sensors 7, such as a coolant temperature sensor and an intake temperature sensor, and the actuators 8, such as an ISC bulb. And while the diagnostic data which it is as a result of [ the ] activation is written in RAM3 and memorized, when abnormalities are in the diagnosed part, it makes the display lamp of a panel turn on and reports abnormalities to an operator.

[0036] After troubleshooting by the diagnostic program is completed next, the diagnostic-data output program of the 2nd area of EEPROM5 transmitted to RAM3 is read, the diagnostic data



memorized by RAM3 is read according to the output program, and it is outputted through a serial bus to the external diagnostic equipment 9. Then, activation partial processing of drawing 5 is ended. And the external diagnostic equipment 9 will be displayed on the display which does not illustrate the diagnostic data if a diagnostic data is given from ECU6.

[0037] Moreover, when it shifted to step R2, and the external diagnostic equipment 9 is not connected but it is judged as "NO" in step R2 after the 1st area read in completion flag was set It is not necessary to transmit a diagnostic data to the external diagnostic equipment 9, and it is judged that there is no read-out demand of the output program memorized in the 2nd area of EEPROM5. It shifts to the processing step R7 of the next "EEPROM read in demand flag reset", and an EEPROM read in demand flag is reset by "0" here. Therefore, since read-out control processing of drawing 6 is judged to be "NO" at step S1 and it escapes from processing immediately after this, read-out of the 2nd area of EEPROM5 is not performed. And if it shifts to the processing step R8 of the following "processing activation of the 1st area" and activation of the diagnostic program of the 1st area of EEPROM5 is performed like step R6, activation partial processing of drawing 5 will be ended.

[0038] Furthermore, when it shifted to step R3 and the processing command from the external diagnostic equipment 9 is not received after the 1st area read in completion flag was set, even if it judges it as "NO" at step R3 and the transfer to RAM3 of the contents of storage of the 2nd area is completed, it does not shift to step R4. Of course, after that, when a processing command is received from the external diagnostic equipment 9, it is judged as "YES" at step R3, and shifts to step R4. And when it is judged as "YES" at step R4, it shifts to steps R5 and R6.

[0039] However, when it is judged as "NO" at step R4, even if it has completed, the transfer to RAM3 of the contents of storage of the 2nd area is judged that the activation is unnecessary, and comes to shift to step R7.

[0040] The storage area of EEPROM5 which was arranged as mentioned above to the ECU6 interior which performs engine control of an automobile according to this example The 1st area which made the decision value data used for the electric fault finding usually performed after engine starting, or its program memorize, When the external diagnostic equipment 9 is connected to ECU6, it classifies and constitutes in the 2nd area which made the program for a diagnostic-data output for transmitting a diagnostic data to the external diagnostic equipment 9 memorize. CPU1 transmits the contents of storage of the 1st area to RAM3 previously, when the external diagnostic equipment 9 is connected, it transmits the contents of storage of the 2nd area to RAM3, and when not connecting, it does not perform the transfer to RAM3 -- it constituted like (it stops).

[0041] Therefore, since unlike the former read-out processing of the 2nd area of unnecessary EEPROM5 cannot be performed and the burden of read-out processing of CPU1 can be mitigated when the external diagnostic equipment 9 is not connected, the processing time can be shortened and it is also possible to assign the part of the mitigated burden to other effective processings.

[0042] moreover, when the external diagnostic equipment 9 is connected to CPU1 and a processing command is not transmitted from the external diagnostic equipment 9 If a transfer of the contents of storage of the 1st area is completed to RAM3, a transfer of the contents of storage of the 2nd area to RAM3 will come to be started succeedingly, but activation is not carried out even if a transfer of the contents of storage of this 2nd area is completed. And the contents of storage of the 1st area and the 2nd area which CPU1 received the processing command from the external diagnostic equipment 9, and were transmitted to RAM3 when the contents of the

processing command were activation need are performed.

[0043] Therefore, activation of the contents of storage of the 1st area and the 2nd area which were transmitted to RAM3 can be made to perform at the time of a request. And even if the contents of storage of the 2nd area are transmitting to RAM3, the transfer can be interrupted by making the contents of the processing command of the external diagnostic equipment 9 into activation needlessness.

[0044] This invention is not limited only to the example which described above and was indicated on the drawing, and the following deformation is possible for it. Although related with troubleshooting, the data or the program which EEPROM5 is made to memorize In EEPROM used for the code collating unit which collates whether the password code which a car antitheft device is sufficient as as long as it is related not only with this but with a car, and is memorized in the key is regular Usually, the 1st password code collated with the password code memorized in the key used well is memorized in the 1st area of EEPROM. It is used in case actuation of the code collating unit itself is inspected, and there is also an example which memorizes the 2nd password code collated with the specific password code inputted from the external device in the 2nd area. What is necessary is to make EEPROM memorize as the 1st area what has high operating frequency in short, and to make what has low operating frequency memorize as the 2nd area, and just to control not to perform read-out, if it judges that there is no read-out demand about the 2nd area (special requirements are not materialized).

[0045] Although the timer interruption period was set to 8ms, the period may be made for a long time or shorter than this. Moreover, processing at a high speed is also possible by making it perform by interruption of the short period of 2ms, only concerning the read-out control processing of EEPROM5 shown in drawing 6 . Furthermore, at the time of one interrupt processing, loop-formation processing may constitute the read-out control processing of EEPROM5 shown in drawing 6 so that the transfer to read-out and RAM3 of a multiaddress may be performed.

[0046] When the processing shown in each drawing of drawing 4 , drawing 5 , and drawing 6 as a series of timer interruption processings is constituted as one program module, respectively, the processing sequence of each of that module in timer interruption processing can be changed not only into the sequence of drawing 4 , drawing 5 , and drawing 6 but into arbitration. It can change [ example / 2nd ] similarly about drawing 9, drawing 10, and drawing 6 . Moreover, an object cannot be restricted to an automobile and it can apply suitably to a general car.

[0047]

[Effect of the Invention] Since this invention is as having explained above, the following effectiveness is done so. According to the control unit for cars according to claim 1, since the contents of storage of the 1st area where operating frequency is higher than a non-volatile storage means are previously transmitted to a working-level month storage means, and it reads when special requirements are materialized, and it transmits to a working-level month storage means about the contents of storage of the 2nd area where operating frequency is low, a control means cannot perform unnecessary read-out and transfer processing, and can mitigate the burden of processing.

[0048] According to the control unit for cars according to claim 2, according to the contents of the processing command in special requirements, a transfer of the contents of storage of the 2nd area to a working-level month storage means can be stopped from a non-volatile storage means, and it can perform alternatively performing the contents of storage of the 2nd area which was interrupted or was transmitted.

[0049] In this case, from the exterior, about processing of troubleshooting, the contents of storage of the 2nd area used by the program about troubleshooting or the data, then the low frequency of a car are read, only when required, and the auxiliary program or data memorized by the non-volatile storage means is transmitted to a working-level month storage means (claim 3).

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## TECHNICAL FIELD

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[Industrial Application] When a program is read from a storage means at the time of program execution, this invention transmits the program to the working-level month storage means in which rapid access is possible, and relates to the control unit for cars which reads subsequent programs from a working-level month storage means, and performs them.

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## PRIOR ART

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[Description of the Prior Art] In the car, for example, an automobile, the engine control is performed by the control device containing a microcomputer, and the engine control program is memorized by storage means, such as ROM.

[0003] Moreover, in an automobile, there is a thing with EEPROM used for the interior of a control unit as an auxiliary storage means. In order that this EEPROM may lessen the number of wiring, many things of the serial communication method which the address and data are synchronized with a clock signal, and transmits and receives them 1 bit at a time are used.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Since this invention is as having explained above, the following effectiveness is done so. According to the control unit for cars according to claim 1, since the contents of storage of the 1st area where operating frequency is higher than a non-volatile storage means are previously transmitted to a working-level month storage means, and it reads when special requirements are materialized, and it transmits to a working-level month storage means about the contents of storage of the 2nd area where operating frequency is low, a control means cannot perform unnecessary read-out and transfer processing, and can mitigate the burden of processing.

[0048] According to the control unit for cars according to claim 2, according to the contents of the processing command in special requirements, a transfer of the contents of storage of the 2nd area to a working-level month storage means can be stopped from a non-volatile storage means, and it can perform alternatively performing the contents of storage of the 2nd area which was interrupted or was transmitted.

[0049] In this case, from the exterior, about processing of troubleshooting, the contents of storage of the 2nd area used by the program about troubleshooting or the data, then the low frequency of a car are read, only when required, and the auxiliary program or data memorized by the non-volatile storage means is transmitted to a working-level month storage means (claim 3).

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] By the way, in this way, when using the serial communication method EEPROM as an object for automobiles, it is assumed that the judgment data used for the electric fault finding about an engine or its troubleshooting are memorized. In this case, after a control program is read from the problem of the read time of EEPROM at the time of engine starting, from EEPROM, electric fault finding and judgment data are read serially, and are transmitted to RAM with a quick access speed. And the electric fault finding transmitted to RAM is read, a diagnosis of each part of an automobile is performed, and, as a result, it is displayed on the panel of a driver's seat by CPU of a microcomputer at the time of failure generating, and is reported to an operator.

[0005] It seems that moreover, the more detailed data of the troubleshooting result which the control unit performed may be displayed on external diagnostic equipment by connecting external diagnostic equipment to a control unit in troubleshooting of an automobile. Therefore, when external diagnostic equipment is connected to EEPROM, it is also assumed that the program for data output for outputting troubleshooting data is also memorized, and at the time of engine starting, with electric fault finding etc., these will also be read from EEPROM and will be transmitted to RAM.

[0006] However, EEPROM of a serial communication method transmits the address and 1 bit of data at a time by clock synchronization as mentioned above, and the read-out takes time amount very much to it. Moreover, the opportunity for external diagnostic equipment to be connected to a control device is the routine inspection time etc., and is rare, and reading the program for data output and data for it over [ EEPROM ] many hours each time, and transmitting to RAM had the fault to which it becomes an excessive processing burden and the processing time becomes long for the control device.

[0007] This invention solves the above-mentioned technical problem, the purpose is the contents of storage of a secondary memory means slack non-volatile storage means, and offering the control unit for cars controlled to carry out only when special requirements are materialized has the transfer to the working-level month storage means of the low auxiliary program or data of operating frequency.

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## MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned purpose, the control unit for cars according to claim 1 A control program storage means by which a control program is memorized, and a working-level month storage means by which a program or data is transmitted at the time of an activity, While performing the control program read from the non-volatile storage means and control program storage means of the serial communication method with which the auxiliary programs or data other than a control program are memorized In what transmitted the auxiliary program or data read from the non-volatile storage means to the working-level month storage means, and possesses the control means which reads and performs an auxiliary program or data from a working-level month storage means henceforth if needed The 1st area where, as for a non-volatile storage means, the high auxiliary program or the data of

operating frequency is memorized, It classifies and memorizes in the 2nd area where the low auxiliary program or the data of operating frequency is memorized. A control means When the contents of storage of the 1st area are previously transmitted to a working-level month storage means and special requirements are materialized, it is characterized by transmitting the contents of storage of the 2nd area to a working-level month storage means.

[0009] The control unit for cars according to claim 2 has the description at the place which constitutes a control means so that the termination of a transfer of the contents of storage of the 2nd area, interruption, or activation of the contents of storage may be chosen according to the contents of the processing command in special requirements.

[0010] In this case, the auxiliary program or data memorized by the non-volatile storage means is good to consider as the program or data about troubleshooting of a car (claim 3).

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## OPERATION

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[Function] According to the control unit for cars according to claim 1, since a control means transmits previously the contents of storage of the 1st area where operating frequency is higher than a non-volatile storage means to a working-level month storage means, and they are read when special requirements are materialized, and it transmits them to a working-level month storage means about the contents of storage of the 2nd area where operating frequency is low, unnecessary read-out and transfer processing are not performed.

[0012] According to the control unit for cars according to claim 2, even when special requirements are materialized, according to the contents of the processing command in the special requirement, the transfer to the working-level month storage means of the contents of storage of the 2nd area is stopped, or it is interrupted or the contents of storage of the 2nd area are performed.

[0013] In this case, from the exterior, about processing of troubleshooting, the contents of storage of the 2nd area used by the program about troubleshooting or the data, then the low frequency of a car are read, only when required, and the auxiliary program or data memorized by the non-volatile storage means is transmitted to a working-level month storage means (claim 3).

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## EXAMPLE

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[Example] This invention is explained with reference to a drawing below about one example at the time of applying to the troubleshooting processing in engine control of the automobile which is a car. In drawing 1 which shows the electric configuration of the part concerning this invention, CPU1 which is a control means is connected to RAM3 which is ROM2 and the working-level month storage means which are a control program storage means through the control signal line at the address and the data bus line list of parallel. The above constitutes the microcomputer (a microcomputer is called below) 4.

[0015] Moreover, there is EEPROM5 of the serial communication method which is a non-volatile storage means in the exterior of a microcomputer 4, and EEPROM5 is connected with CPU1 by serial bus through the serial interface which is not illustrated. And the engine control (ECU is only called hereafter) ECU 6 which controls the engine which is not illustrated as a

control device for cars by the microcomputer 4 and EEPROM5 is constituted.

[0016] Moreover, it connects with CPU1 through the A/D converter which the sensor 7 containing a coolant temperature sensor, an intake temperature sensor, a throttle sensor, etc. does not illustrate, and the actuators 8, such as an injector and an idle speed control (ISC) bulb, are connected through the output circuit which is not illustrated. Furthermore, to ECU6 (CPU1), the external diagnostic equipment 9 is connectable by serial bus through the serial interface which is not illustrated, and CPU1 can be detected now with the detection signal with which the switch for connection detection which is not illustrated outputs whether whether special requirements' being materialized and the external diagnostic equipment 9 are connected.

[0017] In drawing 2 which shows the address map of EEPROM5, it is the 1st area, for example, decision value data, such as opening / short decision value of the coolant temperature sensor as an auxiliary data, opening / short decision value of an intake temperature sensor, and an abnormality decision value in an ISC bulb, are stored the head of an address field to the first half. Moreover, although neither carries out illustration, diagnostic programs which perform troubleshooting using these decision value data, such as a coolant temperature sensor as an auxiliary program, an intake temperature sensor, and an ISC bulb, are also stored. The operating frequency of the diagnostic program and decision value data which are memorized in such 1st area used each time at the time of engine actuation is high.

[0018] It is the 2nd area after the 1st area, and the auxiliary program used since troubleshooting data are outputted to the external diagnostic equipment 9, for example, a coolant temperature sensor, the intake temperature sensor, the program for an ISC bulb diagnostic-data output, etc. are stored. The program for an output memorized in such 2nd area is used only when the external diagnostic equipment 9 is connected to ECU6, and the operating frequency is low.

[0019] Next, an operation of this example is explained also with reference to drawing 3 thru/or drawing 6. In drawing 3 which shows the flow chart of the contents of control in the initialization processing after reset discharge, CPU1 clears first the contents of storage of the field used as a working area of RAM3 zero times in the processing step P1 of "RAM initialization." All the flags that are used by CPU1 in the processing mentioned later as for this zero clearance, setting in software are also reset. And it shifts to the processing step P2 of the next "EEPROM read-out address (N) initialization", and start-address N of the field currently assigned to EEPROM5 on the address map of CPU1 is initialized to an address counter.

[0020] And it will shift to the processing step P3 of an "EEPROM read in demand flag set", and if "1" is written in the field of an EEPROM read in demand flag prepared in RAM3 and the demand flag is set, it shifts to the processing step P4 of the next "interrupt release", and the interrupt-inhibit condition automatically set as the status register of CPU1 by the power up will be canceled, and it will shift to the following step which is not illustrated.

[0021] Then, CPU1 performs engine starting and an engine roll control for a control program in read-out and the main routine which is not illustrated from ROM2. Moreover, it is constituted so that timer interruption may go into CPU1 every 8ms with the timer which is not illustrated.

Drawing 4 thru/or drawing 6 are the flow charts of the contents [ in / in all / the timer interruption processing ] of control.

[0022] In drawing 4 which shows the flow chart of the contents of control accompanying the connection condition of the external diagnostic equipment 9 in timer interruption processing, CPU1 judges first whether the external diagnostic equipment 9 is connected to ECU6 with reference to the detection signal of the connection detection switch which is not illustrated in the decision step Q1 of "external diagnostic-equipment connection ?." If the external diagnostic

equipment 9 is not connected but it is judged as "NO" in the decision step Q1, it will shift to the processing shown in drawing 5 explained below. Moreover, if the external diagnostic equipment 9 is connected and it is judged as "YES" in the decision step Q1, it will shift to the following processing step Q2 of "transmitting a processing command Request-to-Send signal", and if a processing command Request-to-Send signal is transmitted to the external diagnostic equipment 9, it will shift to the processing shown in following drawing 5 .

[0023] In drawing 5 which shows the flow chart of the program execution partial processing (activation partial processing is only called hereafter) memorized by EEPROM5 in timer interruption processing, it is first judged in the decision step R1 of "1st area read in completion flag =1?" whether the 1st area read in completion flag which shows read in completion of the 1st area of EEPROM5 is "1." In an initial state, since 0 \*\*\*\*\* of all flags is carried out in step P1, it is judged as "NO", and it shifts to the processing shown in drawing 6 explained below.

[0024] In drawing 6 which shows the flow chart of read-out control-section processing (control-section processing is only called hereafter) of EEPROM5 in timer interruption processing, it is first judged in the processing step S1 of "EEPROM read in demand flag =1?" whether the EEPROM read in demand flag is set to "1." Here, since it is set to "1" in step P3, it is judged as "YES", and it shifts to the processing step S2 of the following "the address (N) to read-out", and is initialized in step P2, and the contents of storage of the start address of EEPROM5 (coolant temperature sensor opening / short decision value) which counted value N of an address counter shows are read through a serial bus. And it shifts to the processing step S3 of "transmitting to RAM."

[0025] In the processing step S3, the contents of storage of EEPROM5 read at step S2 are transmitted to the field to which it is assigned as a working area of RAM3. And it shifts to decision step S4 of "read in completion [ of the 1st area ] ?" of a degree, and the value and the counter value N which are set up as the last address of the 1st area of EEPROM5 are compared. At this time, by decision step S4, it is judged as "NO", and if it shifts to the processing step S5 of "N= N+1" and counted value N of an address counter is incremented, it will escape from timer interruption processing and it will carry out a return to the main routine which is not illustrated.

[0026] By [ into which timer interruption goes / the processing shown in drawing 4 thru/or drawing 6 so far ] being repeated every 8ms, the contents of storage of the 1st area of EEPROM5 are read from a head the single address every, and are transmitted to RAM3. And in step S5, the increment of the counted value N of an address counter is carried out, and it goes, and if it becomes equal to the value set up as the last address of the 1st area, in step S4, it will be judged as "YES", and will shift to the processing step S6 of the following "1st area read in completion flag set."

[0027] In the processing step S6, the 1st area read in completion flag which shows read in completion of the 1st area is set to "1", and it shifts to the decision step S7 of "read in completion [ of the 2nd area ] ?", and is compared with the value to which counted value N of an address counter is set as the last address of the 2nd area. At this time, at the decision step S7, it is judged as "NO", and if it shifts to the processing step S5 and counted value N of an address counter is incremented (counted value N becomes equal to the start address of the 2nd area at this time), it will escape from timer interruption processing and it will carry out a return to the main routine which is not illustrated.

[0028] Next, if timer interruption enters, since the read in completion flag of the 1st area is set to "1", it will be judged to be "YES" in step R1 of drawing 5 . And if it shifts to the decision step R2 of "external diagnostic-equipment connection ?", it will be judged whether the external

diagnostic equipment 9 is connected to ECU6 (are special requirements materialized or not?). Here, supposing the external diagnostic equipment 9 is connected, in the decision step R2, it will be judged as "YES", and it will be judged whether it shifted to the decision step R3 of "processing command receiving [ from external diagnostic equipment ] ?" of a degree, and the processing command was received from the external diagnostic equipment 9.

[0029] In the decision step R3, if a processing command is not received from the external diagnostic equipment 9 but it is judged as "NO", it will escape from the activation partial processing shown in drawing 5 , and will shift to the control-section processing shown in drawing 6 . In the decision step R3, if the processing command is received from the external diagnostic equipment 9 and it is judged as "YES", it will shift to the following decision step R4 of "whether a processing command is 1", and the contents of the processing command from the external diagnostic equipment 9 will judge "1" and no ("0"). In this case, the contents "1" of the processing command show the activation need for the contents of storage of the 2nd area, and the contents "0" show activation needlessness conversely. If it is judged as "YES" at this decision step R4, it will be judged whether the 2nd area read in completion flag which shifts to the decision step R5 of "2nd area read in completion flag =1?" of a degree, and shows read in completion of the 2nd area of EEPROM5 is set to "1." At this time, since the 2nd area of EEPROM5 is not read yet, it is judged to be "NO" in the decision step R5, escapes from the activation partial processing shown in drawing 5 , and shifts to the control-section processing shown in drawing 6 .

[0030] And in step S2 of drawing 6 , the contents of storage of the start address of the 2nd area of EEPROM5 which counted value N of an address counter shows at this time (head part of a coolant temperature sensor diagnostic-data output program) are read. And in the following step S3, the contents of storage are transmitted to RAM3 like the case of the 1st area.

[0031] In the following step S4, since it has completed, the read in of the 1st area judges it as "YES", and it repeats flag set actuation at step S6. In the following step S7, since it is judged as "NO" at this time, if counted value N is incremented at step S5, it will shift to the main routine which does not escape from and illustrate timer interruption processing.

[0032] By repeating the processing so far every 8ms containing timer interruption henceforth, like the case of the 1st area mentioned above, the contents of storage of the 2nd area of EEPROM5 are read from a head the single address every, and are transmitted to RAM3. And the increment of the counted value N is carried out in step S5, and it goes, and if it becomes equal to the value set up as the last address of the 2nd area, in step S7, it will be judged as "YES", and will shift to the processing step S8 of the following "2nd area read in completion flag set."

[0033] In the processing step S8, if the 2nd area read in completion flag which shows read in completion of the 2nd area is set to "1", it will shift to processing step S9 of the next "EEPROM read in demand flag reset", and if the EEPROM read in demand flag set to "1" in step P3 is set to "0" and reset, it will escape from timer interruption processing and a return will be carried out to a main routine. In the processing at the time of the timer interruption after this time, in order to judge it as "NO" in step S1, the control-section processing shown in drawing 6 after it escapes from and carries out the return of the interruption handling routine, without being carried out.

[0034] And in the next timer interruption processing, since the read in completion flag of the 2nd area is set, if it is judged as "YES" in step R4 of drawing 5 and shifts to step R5, it will be judged as "YES" here and will shift to the processing step R6 of the following "processing activation of the 1st and 2nd area."

[0035] In the processing step R6, the electric fault finding and decision value data of the 1st area



of EEPROM5 which were transmitted to RAM3 are read, and the diagnostic program is performed to the sensors 7, such as a coolant temperature sensor and an intake temperature sensor, and the actuators 8, such as an ISC bulb. And while the diagnostic data which it is as a result of [ the ] activation is written in RAM3 and memorized, when abnormalities are in the diagnosed part, it makes the display lamp of a panel turn on and reports abnormalities to an operator.

[0036] After troubleshooting by the diagnostic program is completed next, the diagnostic-data output program of the 2nd area of EEPROM5 transmitted to RAM3 is read, the diagnostic data memorized by RAM3 is read according to the output program, and it is outputted through a serial bus to the external diagnostic equipment 9. Then, activation partial processing of drawing 5 is ended. And the external diagnostic equipment 9 will be displayed on the display which does not illustrate the diagnostic data if a diagnostic data is given from ECU6.

[0037] Moreover, when it shifted to step R2, and the external diagnostic equipment 9 is not connected but it is judged as "NO" in step R2 after the 1st area read in completion flag was set It is not necessary to transmit a diagnostic data to the external diagnostic equipment 9, and it is judged that there is no read-out demand of the output program memorized in the 2nd area of EEPROM5. It shifts to the processing step R7 of the next "EEPROM read in demand flag reset", and an EEPROM read in demand flag is reset by "0" here. Therefore, since read-out control processing of drawing 6 is judged to be "NO" at step S1 and it escapes from processing immediately after this, read-out of the 2nd area of EEPROM5 is not performed. And if it shifts to the processing step R8 of the following "processing activation of the 1st area" and activation of the diagnostic program of the 1st area of EEPROM5 is performed like step R6, activation partial processing of drawing 5 will be ended.

[0038] Furthermore, when it shifted to step R3 and the processing command from the external diagnostic equipment 9 is not received after the 1st area read in completion flag was set, even if it judges it as "NO" at step R3 and the transfer to RAM3 of the contents of storage of the 2nd area is completed, it does not shift to step R4. Of course, after that, when a processing command is received from the external diagnostic equipment 9, it is judged as "YES" at step R3, and shifts to step R4. And when it is judged as "YES" at step R4, it shifts to steps R5 and R6.

[0039] However, when it is judged as "NO" at step R4, even if it has completed, the transfer to RAM3 of the contents of storage of the 2nd area is judged that the activation is unnecessary, and comes to shift to step R7.

[0040] The storage area of EEPROM5 which was arranged as mentioned above to the ECU6 interior which performs engine control of an automobile according to this example The 1st area which made the decision value data used for the electric fault finding usually performed after engine starting, or its program memorize, When the external diagnostic equipment 9 is connected to ECU6, it classifies and constitutes in the 2nd area which made the program for a diagnostic-data output for transmitting a diagnostic data to the external diagnostic equipment 9 memorize. CPU1 transmits the contents of storage of the 1st area to RAM3 previously, when the external diagnostic equipment 9 is connected, it transmits the contents of storage of the 2nd area to RAM3, and when not connecting, it does not perform the transfer to RAM3 -- it constituted like (it stops).

[0041] Therefore, since unlike the former read-out processing of the 2nd area of unnecessary EEPROM5 cannot be performed and the burden of read-out processing of CPU1 can be mitigated when the external diagnostic equipment 9 is not connected, the processing time can be shortened and it is also possible to assign the part of the mitigated burden to other effective

processings.

[0042] moreover, when the external diagnostic equipment 9 is connected to CPU1 and a processing command is not transmitted from the external diagnostic equipment 9 If a transfer of the contents of storage of the 1st area is completed to RAM3, a transfer of the contents of storage of the 2nd area to RAM3 will come to be started succeedingly, but activation is not carried out even if a transfer of the contents of storage of this 2nd area is completed. And the contents of storage of the 1st area and the 2nd area which CPU1 received the processing command from the external diagnostic equipment 9, and were transmitted to RAM3 when the contents of the processing command were activation need are performed.

[0043] Therefore, activation of the contents of storage of the 1st area and the 2nd area which were transmitted to RAM3 can be made to perform at the time of a request. And even if the contents of storage of the 2nd area are transmitting to RAM3, the transfer can be interrupted by making the contents of the processing command of the external diagnostic equipment 9 into activation needlessness.

[0044] This invention is not limited only to the example which described above and was indicated on the drawing, and the following deformation is possible for it. Although related with troubleshooting, the data or the program which EEPROM5 is made to memorize In EEPROM used for the code collating unit which collates whether the password code which a car antitheft device is sufficient as as long as it is related not only with this but with a car, and is memorized in the key is regular Usually, the 1st password code collated with the password code memorized in the key used well is memorized in the 1st area of EEPROM. It is used in case actuation of the code collating unit itself is inspected, and there is also an example which memorizes the 2nd password code collated with the specific password code inputted from the external device in the 2nd area. What is necessary is to make EEPROM memorize as the 1st area what has high operating frequency in short, and to make what has low operating frequency memorize as the 2nd area, and just to control not to perform read-out, if it judges that there is no read-out demand about the 2nd area (special requirements are not materialized).

[0045] Although the timer interruption period was set to 8ms, the period may be made for a long time or shorter than this. Moreover, processing at a high speed is also possible by making it perform by interruption of the short period of 2ms, only concerning the read-out control processing of EEPROM5 shown in drawing 6 . Furthermore, at the time of one interrupt processing, loop-formation processing may constitute the read-out control processing of EEPROM5 shown in drawing 6 so that the transfer to read-out and RAM3 of a multiaddress may be performed.

[0046] When the processing shown in each drawing of drawing 4 , drawing 5 , and drawing 6 as a series of timer interruption processings is constituted as one program module, respectively, the processing sequence of each of that module in timer interruption processing can be changed not only into the sequence of drawing 4 , drawing 5 , and drawing 6 but into arbitration. It can change [ example / 2nd ] similarly about drawing 9, drawing 10, and drawing 6 . Moreover, an object cannot be restricted to an automobile and it can apply suitably to a general car.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the electric configuration of one example of this invention

[Drawing 2] The address map of EEPROM

[Drawing 3] The flow chart which shows the contents of control of initialization processing

[Drawing 4] The flow chart accompanying the connection condition of the external diagnostic equipment in timer interruption processing

[Drawing 5] The flow chart which shows the program execution part memorized by EEPROM in timer interruption processing

[Drawing 6] The flow chart which shows the read-out control section of EEPROM in timer interruption processing

[Description of Notations]

1 -- EEPROM (non-volatile storage means), and 6 and 12 show the engine control ECU (control unit for cars), and, as for ROM (control program storage means) and 3, in CPU (control means), and 2 and 10, 9 shows external diagnostic equipment, as for RAM (working-level month storage means), and 5 and 11.

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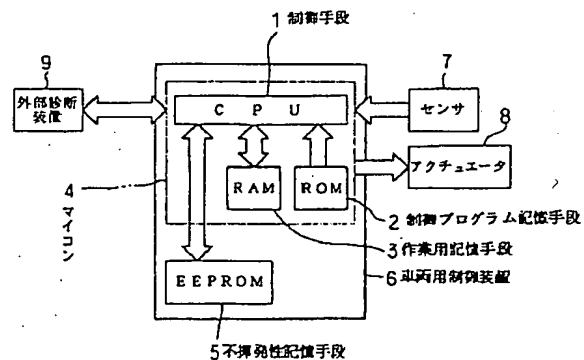
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(54) 【発明の名称】 車両用制御装置

(57) 【要約】

【目的】 シリアル通信方式不揮発性記憶手段の記憶内容の内の使用頻度の低いプログラム若しくはデータについては、特殊要件が成立したときに読出して作業用記憶手段に転送する。

【構成】 自動車のエンジン制御を行うECU6に配置させたシリアル通信方式EEPROM5の記憶エリアを、エンジン始動後に通常実行される故障診断プログラムや判定値データなどを記憶させた第1エリアと、ECU6に外部診断装置9が接続された場合にのみ使用されるデータ出力用プログラムを記憶させた第2エリアとに分別して構成し、CPU1は、第1エリアの記憶内容を先にRAM3に対して転送し、第2エリアの記憶内容は、外部診断装置9が接続されたときに読出してRAM3に転送するように構成した。



【特許請求の範囲】

【請求項 1】 制御プログラムが記憶される制御プログラム記憶手段と、

作業時にプログラム若しくはデータが転送される作業用記憶手段と、

制御プログラム以外の補助プログラム若しくはデータが記憶されるシリアル通信方式の不揮発性記憶手段と、

制御プログラム記憶手段より読出した制御プログラムを実行すると共に、前記不揮発性記憶手段から読出した補助プログラム若しくはデータを前記作業用記憶手段に転送し、以降は必要に応じて作業用記憶手段から補助プログラムまたはデータを読出して実行する制御手段とを具備した車両用制御装置において、

前記不揮発性記憶手段は、使用頻度の高い補助プログラム若しくはデータが記憶される第 1 エリアと、使用頻度の低い補助プログラム若しくはデータが記憶される第 2 エリアとに分別されて記憶され、前記制御手段は、第 1 エリアの記憶内容を先に前記作業用記憶手段に転送し、特殊要件が成立しているときに第 2 エリアの記憶内容を作業用記憶手段に転送することを特徴とする車両用制御装置。

【請求項 2】 制御手段は、特殊要件中の処理コマンドの内容に応じて第 2 エリアの記憶内容の転送の中止、中断若しくはその記憶内容の実行を選択するように構成されていることを特徴とする請求項 1 記載の車両用制御装置。

【請求項 3】 不揮発性記憶手段に記憶される補助プログラム若しくはデータは、車両の故障診断に関するプログラム若しくはデータであることを特徴とする請求項 1 又は 2 記載の車両用制御装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、プログラムの実行時に記憶手段よりプログラムを読出すと、そのプログラムを高速アクセスが可能な作業用記憶手段に転送して、以降のプログラムを作業用記憶手段から読出して実行する車両用制御装置に関する。

【0002】

【従来の技術】車両例えば自動車においては、そのエンジン制御はマイクロコンピュータを含む制御装置によって行われており、エンジンの制御プログラムは ROM などの記憶手段に記憶されている。

【0003】また、自動車においては、制御装置の内部に補助的な記憶手段として用いられる E E P R O M を持つものがある。この E E P R O M は、配線数を少なくするためにアドレス及びデータをクロック信号に同期させて 1 ビットずつ送受信するシリアル通信方式のものが多く用いられている。

【0004】

【発明が解決しようとする課題】ところでこのように、

シリアル通信方式 E E P R O M を自動車用として使用する場合には、例えばエンジンについての故障診断プログラムやその故障診断に用いる判定データなどが記憶されることが想定される。この場合は、E E P R O M の読出し時間の問題からエンジンの始動時に制御プログラムが読出された後、E E P R O M より故障診断プログラム及び判定データがシリアルに読出されて、アクセススピードの速い R A M に転送される。そして、マイコンの C P U により、R A M に転送された故障診断プログラムが読出されて自動車の各部の診断が行われ、その結果故障発生時には、例えば運転席のパネルに表示されるなどして運転者に報知される。

【0005】また、自動車の故障診断においては、制御装置に外部診断装置が接続されることにより、制御装置が行った故障診断結果のより詳細なデータを、外部診断装置に表示させるような場合がある。そのため、E E P R O M には、外部診断装置が接続された場合に故障診断データを出力するためのデータ出力用プログラムも記憶されることも想定され、これらも、エンジン始動時に故障診断プログラムなどと共に E E P R O M より読出されて R A M に転送されることになる。

【0006】しかしながら、シリアル通信方式の E E P R O M は、前述のようにアドレス及びデータをクロック同期で 1 ビットずつ転送するものであり、その読出しには非常に時間を要する。また、外部診断装置が制御装置に接続される機会は定期点検時などであって希少であり、そのためのデータ出力用プログラム及びデータを毎回時間をかけて E E P R O M より読込んで R A M に転送するのは、制御装置にとっては余分な処理負担となり、処理時間が長くなる不具合があった。

【0007】本発明は上記課題を解決するもので、その目的は、補助記憶手段たる不揮発性記憶手段の記憶内容で、使用頻度の低い補助プログラム若しくはデータの作業用記憶手段への転送は、特殊要件が成立したときのみ行うように制御する車両用制御装置を提供するにある。

【0008】

【課題を解決するための手段】上記目的を達成するため、請求項 1 記載の車両用制御装置は、制御プログラムが記憶される制御プログラム記憶手段と、作業時にプログラム若しくはデータが転送される作業用記憶手段と、制御プログラム以外の補助プログラム若しくはデータが記憶されるシリアル通信方式の不揮発性記憶手段と、制御プログラム記憶手段より読出した制御プログラムを実行すると共に、不揮発性記憶手段から読出した補助プログラム若しくはデータを作業用記憶手段に転送し、以降は必要に応じて作業用記憶手段から補助プログラムまたはデータを読出して実行する制御手段とを具備したものである。不揮発性記憶手段は、使用頻度の高い補助プログラム若しくはデータが記憶される第 1 エリアと、使用頻度の低い補助プログラム若しくはデータが記憶され

る第2エリアとに分別されて記憶され、制御手段は、第1エリアの記憶内容を先に作業用記憶手段に転送し、特殊要件が成立しているときに第2エリアの記憶内容を作業用記憶手段に転送することを特徴とするものである。

【0009】請求項2記載の車両用制御装置は、制御手段を、特殊要件中の処理コマンドの内容に応じて第2エリアの記憶内容の転送の中止、中断若しくはその記憶内容の実行を選択するように構成するところに特徴を有する。

【0010】この場合、不揮発性記憶手段に記憶される補助プログラム若しくはデータは、車両の故障診断に関するプログラム若しくはデータとすると良い（請求項3）。

【0011】

【作用】請求項1記載の車両用制御装置によれば、制御手段は、不揮発性記憶手段より使用頻度の高い第1エリアの記憶内容を先に作業用記憶手段に転送し、使用頻度の低い第2エリアの記憶内容については、特殊要件が成立しているときに読出して作業用記憶手段に転送するので、不必要な読出し及び転送処理を行うことがない。

【0012】請求項2記載の車両用制御装置によれば、特殊要件が成立している場合でも、その特殊要件中の処理コマンドの内容に応じて第2エリアの記憶内容の作業用記憶手段への転送を中止し、または、中断し、若しくは、第2エリアの記憶内容を実行させる。

【0013】この場合、不揮発性記憶手段に記憶される補助プログラム若しくはデータを、車両の故障診断に関するプログラム若しくはデータとすれば、低い頻度で使用される第2エリアの記憶内容は、外部より故障診断の処理に関して必要な時だけ読出されて、作業用記憶手段に転送される（請求項3）。

【0014】

【実施例】以下本発明を車両である自動車のエンジン制御における故障診断処理に適用した場合の一実施例について図面を参照して説明する。本発明に係る部分の電気的構成を示す図1において、制御手段であるCPU1は、制御プログラム記憶手段であるROM2及び作業用記憶手段であるRAM3にパラレルのアドレス及びデータバスライン並びに制御信号線を介して接続されている。以上がマイクロコンピュータ（以下マイコンと称す）4を構成している。

【0015】また、マイコン4の外部には、不揮発性記憶手段であるシリアル通信方式のEEPROM5があり、EEPROM5はCPU1と図示しないシリアルインターフェイスを介してシリアルバスで接続されている。そして、マイコン4及びEEPROM5により車両用制御装置としての図示しないエンジンを制御するエンジン制御ECU（以下、単にECUと称す）6を構成している。

【0016】また、CPU1には、水温センサ、吸気温

センサやスロットルセンサなどを含むセンサ7が図示しないA/D変換器を介して接続されており、インジェクタやアイドルスピードコントロール（ISC）バルブなどのアクチュエータ8が、図示しない出力回路を介して接続されている。更に、ECU6（CPU1）には、例えば外部診断装置9が、図示しないシリアルインターフェイスを介してシリアルバスで接続が可能となっており、CPU1は、特殊要件が成立しているか否か、即ち、外部診断装置9が接続されているか否かを、図示しない接続検知用スイッチが出力する検知信号により検知することができるようになっている。

【0017】EEPROM5のアドレスマップを示す図2において、アドレス領域の先頭から前半は第1エリアであり、例えば、補助データとしての水温センサのオープン/ショート判定値、吸気温センサのオープン/ショート判定値やISCバルブ異常判定値などの判定値データが格納されている。また、何れも図示はしないが、これらの判定値データを使用して故障診断を行う補助プログラムとしての水温センサ、吸気温センサやISCバルブなどの診断プログラムも格納されている。これらの第1エリアに記憶されている診断プログラム及び判定値データは、エンジンの作動時において毎回使用される使用頻度の高いものである。

【0018】第1エリア以降は第2エリアであり、外部診断装置9に故障診断データを出力するために使用される補助プログラム、例えば、水温センサ、吸気温センサやISCバルブ診断データ出力用プログラムなどが格納されている。これらの第2エリアに記憶されている出力用プログラムは、外部診断装置9がECU6に接続されているときのみ使用されるものであり、その使用頻度は低い。

【0019】次に本実施例の作用を図3乃至図6をも参照して説明する。リセット解除後のイニシャライズ処理における制御内容のフローチャートを示す図3において、まず、「RAMイニシャライズ」の処理ステップP1において、CPU1は、RAM3の作業領域として使用される領域の記憶内容を0クリアする。この0クリアによって、後述する処理において、CPU1によりソフト的にセットされて使用されるフラグも全てリセットされる。そして、次の「EEPROM読出しアドレス（N）初期設定」の処理ステップP2に移行して、CPU1のアドレスマップ上でEEPROM5に割当てられている領域の先頭アドレスNを、アドレスカウンタに初期設定する。

【0020】そして、「EEPROM読込み要求フラグセット」の処理ステップP3に移行して、RAM3内に設けられているEEPROM読込み要求フラグの領域に「1」を書込んでその要求フラグをセットすると、次の「割込み禁止解除」の処理ステップP4に移行し、電源投入時にCPU1のステータスレジスタに自動的に設定

される割込み禁止状態を解除して、図示しない次のステップに移行する。

【0021】その後、CPU1は、ROM2より制御プログラムを読み出し、図示しないメインルーチンにおいてエンジンの始動及び回転制御を行う。また、CPU1には図示しないタイマによって8ms毎にタイマ割込みが入るように構成されている。図4乃至図6は、いずれもそのタイマ割込み処理における制御内容のフローチャートである。

【0022】タイマ割込み処理における外部診断装置9の接続状態に伴う制御内容のフローチャートを示す図4では、まず、「外部診断装置接続？」の判断ステップQ1において、CPU1は、図示しない接続検知スイッチの検知信号を参照して、ECU6に外部診断装置9が接続されているか否かを判断する。外部診断装置9が接続されておらず、判断ステップQ1において「NO」と判断すると、次に説明する図5に示す処理に移行する。また、外部診断装置9が接続されており、判断ステップQ1において「YES」と判断すると、次の「処理コマンド送信要求信号を送信」の処理ステップQ2に移行して、外部診断装置9に対して処理コマンド送信要求信号を送信すると、次の図5に示す処理に移行する。

【0023】タイマ割込み処理におけるEEPROM5に記憶されたプログラムの実行部分処理（以下、単に実行部分処理と称す）のフローチャートを示す図5において、まず、「第1エリア読み込み完了フラグ=1？」の判断ステップR1において、EEPROM5の第1エリアの読み込み完了を示す、第1エリア読み込み完了フラグが「1」であるか否かが判断される。初期状態では、ステップP1においてフラグは全て0クリアされているので「NO」と判断して、次に説明する図6に示す処理に移行する。

【0024】タイマ割込み処理におけるEEPROM5の読み出し制御部分処理（以下、単に制御部分処理と称す）のフローチャートを示す図6において、まず、「EEPROM読み込み要求フラグ=1？」の処理ステップS1において、EEPROM読み込み要求フラグが「1」にセットされているか否かが判断される。ここでは、ステップP3において「1」にセットされているので「YES」と判断して、次の「アドレス(N)から読み出し」の処理ステップS2に移行して、ステップP2において初期化され、アドレスカウンタのカウンタ値Nが示しているEEPROM5の先頭アドレスの記憶内容（水温センサオープン/ショート判定値）を、シリアルバスを介して読み出す。そして、「RAMに転送」の処理ステップS3に移行する。

【0025】処理ステップS3においては、ステップS2で読み出したEEPROM5の記憶内容を、RAM3の作業領域として割当てられている領域に転送する。そして、次の「第1エリアの読み込み完了？」の判断ステップ

S4に移行して、EEPROM5の第1エリアの最終アドレスとして設定されている値とカウンタ値Nとを比較する。この時点では、判断ステップS4では「NO」と判断して、「N=N+1」の処理ステップS5に移行してアドレスカウンタのカウンタ値Nをインクリメントすると、タイマ割込み処理を抜けて、図示しないメインルーチンにリターンする。

【0026】ここまでの図4乃至図6に示した処理が、タイマ割込みが入る8ms毎に繰返されることにより、EEPROM5の第1エリアの記憶内容は、先頭からアドレスずつ読み出されてRAM3に転送される。そして、アドレスカウンタのカウンタ値NがステップS5においてインクリメントされて行き、第1エリアの最終アドレスとして設定されている値と等しくなると、ステップS4において「YES」と判断して、次の「第1エリア読み込み完了フラグセット」の処理ステップS6に移行する。

【0027】処理ステップS6においては、第1エリアの読み込み完了を示す、第1エリア読み込み完了フラグを「1」にセットし、「第2エリアの読み込み完了？」の判断ステップS7に移行して、アドレスカウンタのカウンタ値Nが第2エリアの最終アドレスとして設定されている値と比較される。この時点では、判断ステップS7では「NO」と判断して、処理ステップS5に移行してアドレスカウンタのカウンタ値Nをインクリメントすると（この時点で、カウンタ値Nは第2エリアの先頭アドレスに等しくなる）、タイマ割込み処理を抜けて、図示しないメインルーチンにリターンする。

【0028】次にタイマ割込みが入ると、第1エリアの読み込み完了フラグは「1」にセットされているため、図5のステップR1においては「YES」と判断する。そして、「外部診断装置接続？」の判断ステップR2に移行すると、外部診断装置9がECU6に接続されているか否か（特殊要件が成立しているか否か）が判断される。ここで、外部診断装置9が接続されているとすると、判断ステップR2において「YES」と判断し、次の「外部診断装置から処理コマンド受信？」の判断ステップR3に移行して、外部診断装置9から処理コマンドを受信したか否かが判断される。

【0029】判断ステップR3において、外部診断装置9から処理コマンドを受信しておらず「NO」と判断すると、図5に示す実行部分処理を抜けて、図6に示す制御部分処理に移行する。判断ステップR3において、外部診断装置9から処理コマンドを受信しており「YES」と判断すると、次の「処理コマンドは1か？」の判断ステップR4に移行して外部診断装置9からの処理コマンドの内容が「1」か否（「0」）かを判断する。この場合、処理コマンドの内容「1」は第2エリアの記憶内容の実行必要を示し、逆に、内容「0」は実行不要を示す。この判断ステップR4で「YES」と判断する

と、次の「第2エリア読み完了フラグ=1?」の判断ステップR5に移行して、EEPROM5の第2エリアの読み完了を示す、第2エリア読み完了フラグが「1」にセットされているか否かが判断される。この時点では、EEPROM5の第2エリアはまだ読み込まれていないので、判断ステップR5において「NO」と判断して、図5に示す実行部分処理を抜けて、図6に示す制御部分処理に移行する。

【0030】そして、図6のステップS2においては、この時点でアドレスカウンタのカウント値Nが示しているEEPROM5の第2エリアの先頭アドレスの記憶内容（水温センサ診断データ出力プログラムの先頭部分）が読み出される。そして、第1エリアの場合と同様に、次のステップS3において、その記憶内容はRAM3に転送される。

【0031】次のステップS4においては、第1エリアの読み込みは完了しているので「YES」と判断して、ステップS6でのフラグセット動作を繰返す。次のステップS7においては、この時点では「NO」と判断するので、ステップS5でカウント値Nをインクリメントすると、タイマ割込み処理を抜けて図示しないメインルーチンに移行する。

【0032】以降ここまでの処理は、タイマ割込みが入る8ms毎に繰返されることにより、EEPROM5の第2エリアの記憶内容は、前述した第1エリアの場合と同様に、先頭から1アドレスずつ読み出されてRAM3に転送される。そして、カウント値NがステップS5においてインクリメントされて行き、第2エリアの最終アドレスとして設定されている値と等しくなると、ステップS7において「YES」と判断して、次の「第2エリア読み完了フラグセット」の処理ステップS8に移行する。

【0033】処理ステップS8においては、第2エリアの読み込み完了を示す、第2エリア読み完了フラグが「1」にセットされると、次の「EEPROM読み要求フラグリセット」の処理ステップS9に移行して、ステップP3において「1」にセットされたEEPROM読み要求フラグを「0」にしてリセットすると、タイマ割込み処理を抜けてメインルーチンにリターンする。この時点以降のタイマ割込み時の処理では、ステップS1において「NO」と判断するため、それ以降の図6に示す制御部分処理は行われずに割込み処理ルーチンを抜けてリターンする。

【0034】そして、次のタイマ割込み処理では、第2エリアの読み込み完了フラグがセットされているので、図5のステップR4において「YES」と判断されてステップR5に移行すると、ここで「YES」と判断して、次の「第1及び第2エリアの処理実行」の処理ステップR6に移行する。

【0035】処理ステップR6においては、RAM3に

転送されたEEPROM5の第1エリアの故障診断プログラム及び判定値データが読み出され、水温センサや吸気温度センサなどのセンサ7や、ISCバルブなどのアクチュエータ8に対してその診断プログラムが実行される。そして、その実行結果である診断データは、RAM3に書き込まれて記憶されると共に、診断した部分に異常があった場合は、パネルの表示ランプを点灯させるなどして、運転者に異常の報知を行う。

【0036】診断プログラムによる故障診断が終了すると、次に、RAM3に転送されたEEPROM5の第2エリアの診断データ出力プログラムが読み出され、その出力プログラムに従って、RAM3に記憶された診断データが読み出されて外部診断装置9に対してシリアルバスを介して出力される。すると、図5の実行部分処理を終了する。そして、外部診断装置9は、ECU6から診断データが与えられると、その診断データを図示しない表示部などに表示させる。

【0037】また、第1エリア読み完了フラグがセットされた後、ステップR2に移行した時点で外部診断装置9が接続されておらず、ステップR2において「NO」と判断した場合は、外部診断装置9に対して診断データを送信する必要はなく、EEPROM5の第2エリアに記憶された出力プログラムの読み出し要求はないと判断して、次の「EEPROM読み要求フラグリセット」の処理ステップR7に移行して、ここでEEPROM読み要求フラグは「0」にリセットされる。従って、これ以降は、図6の読み出し制御処理はステップS1で「NO」と判断されてすぐに処理を抜けるので、EEPROM5の第2エリアの読み出しは行われない。そして、次の「第1エリアの処理実行」の処理ステップR8に移行して、EEPROM5の第1エリアの診断プログラムの実行がステップR6と同様に行われると、図5の実行部分処理を終了する。

【0038】更に、第1エリア読み完了フラグがセットされた後、ステップR3に移行した時点で外部診断装置9からの処理コマンドを受信しなかった場合には、ステップR3で「NO」と判断して、第2エリアの記憶内容のRAM3への転送が完了しても、ステップR4へは移行しない。勿論、その後、外部診断装置9から処理コマンドを受信した場合には、ステップR3で「YES」と判断してステップR4に移行する。そして、ステップR4で「YES」と判断したときにはステップR5及びR6へと移行する。

【0039】しかしながら、ステップR4で「NO」と判断した場合には、第2エリアの記憶内容のRAM3への転送は完了していても、その実行は不要と判断してステップR7に移行するようになる。

【0040】以上のように本実施例によれば、自動車のエンジン制御を行うECU6内部に配置させたEEPROM5の記憶エリアを、エンジン始動後に通常実行され



る故障診断プログラムやそのプログラムに使用される判定値データなどを記憶させた第1エリアと、ECU6に外部診断装置9が接続された場合に、外部診断装置9に対して診断データを送信するための診断データ出力用プログラムを記憶させた第2エリアとに分別して構成し、CPU1は、第1エリアの記憶内容を先にRAM3に対して転送して、第2エリアの記憶内容は、外部診断装置9が接続されているときにはRAM3に対して転送し、接続されていないときにはRAM3に対する転送を行わない(中止する)ように構成した。

【0041】従って、従来とは異なり、外部診断装置9が接続されていない場合は不必要なEEPROM5の第2エリアの読出し処理を行うことがなく、CPU1の読出し処理の負担を軽減することができるので、処理時間を短縮することができ、その軽減された負担の分を、他の有効な処理に対して割当てることが可能である。

【0042】また、CPU1に対して外部診断装置9が接続されていた場合において、外部診断装置9から処理コマンドが送信されてこなかったときには、RAM3に対して第1エリアの記憶内容の転送が終了すれば、引き続いてRAM3に対する第2エリアの記憶内容の転送が開始されるようになるが、この第2エリアの記憶内容の転送が終了しても実行はされない。そして、外部診断装置9からの処理コマンドをCPU1が受信し、且つ、その処理コマンドの内容が実行必要の場合には、RAM3に転送された第1エリア及び第2エリアの記憶内容を実行する。

【0043】従って、RAM3に転送された第1エリア及び第2エリアの記憶内容の実行は所望の時にに行わせることができる。しかも、第2エリアの記憶内容がRAM3への転送中であっても、外部診断装置9の処理コマンドの内容を実行不要とすることにより、その転送を中断することができる。

【0044】本発明は上記しかつ図面に記載した実施例にのみ限定されるものではなく、次のような変形が可能である。EEPROM5に記憶させるデータ若しくはプログラムを、故障診断に関するものとしたが、これに限らず、車両に関するものであれば例えば車両盗難防止装置でも良く、キー内に記憶されている暗証コードが正規なものかを照合するコード照合ユニットに使われるEEPROMにおいて、通常良く使うキー内に記憶されている暗証コードと照合される第1の暗証コードをEEPROMの第1エリアに記憶しておき、コード照合ユニット自体の動作を検査する際に使用され、外部装置から入力された特定暗証コードと照合される第2の暗証コードを第2エリアに記憶する実施例もある。要は、使用頻度の高いものをEEPROMに第1エリアとして記憶させ、且つ、使用頻度の低いものを第2エリアとして記憶させて、第2エリアについては読出し要求が無い(特殊要件が成立していない)と判断すると読出しを行わないよう

に制御すれば良い。

【0045】タイマ割込み周期を8msとしたが、その周期をこれより長くまたは短くしても良い。また、図6に示したEEPROM5の読出し制御処理に関してのみ、例えば2msの短い周期の割込みで実行させることにより、高速に処理することも可能である。更に、図6に示したEEPROM5の読出し制御処理を、1回の割込み処理時にループ処理によって、複数アドレスの読出し及びRAM3への転送を行うように構成しても良い。

【0046】一連のタイマ割込み処理として図4、図5及び図6の各図に示した処理をそれぞれ一つのプログラムモジュールとして構成した場合は、タイマ割込み処理におけるその各モジュールの処理順序は、図4、図5、図6の順序に限らず、任意に変更が可能である。第2実施例についても、図9、図10、図6について同様に変更が可能である。また、対象を自動車に限ることはなく、車両一般に対して適宜応用することができる。

【0047】

【発明の効果】本発明は以上説明した通りであるので、以下の効果を奏する。請求項1記載の車両用制御装置によれば、制御手段は、不揮発性記憶手段より使用頻度の高い第1エリアの記憶内容を先に作業用記憶手段に転送し、使用頻度の低い第2エリアの記憶内容については、特殊要件が成立したときに読出して作業用記憶手段に転送するので、不必要な読出し及び転送処理を行うことがなく、処理の負担を軽減することができる。

【0048】請求項2記載の車両用制御装置によれば、特殊要件中の処理コマンドの内容に応じて、不揮発性記憶手段から作業用記憶手段に対する第2エリアの記憶内容の転送を中止し、中断し、若しくは転送された第2エリアの記憶内容を実行することを選択的に行うことができる。

【0049】この場合、不揮発性記憶手段に記憶される補助プログラム若しくはデータを、車両の故障診断に関するプログラム若しくはデータとすれば、低い頻度で使用される第2エリアの記憶内容は、外部より故障診断の処理に関して必要な時だけ読出されて、作業用記憶手段に転送される(請求項3)。

【図面の簡単な説明】

【図1】本発明の一実施例の電気的構成を示すブロック図

【図2】EEPROMのアドレスマップ

【図3】イニシャライズ処理の制御内容を示すフローチャート

【図4】タイマ割込み処理における外部診断装置の接続状態に伴うフローチャート

【図5】タイマ割込み処理におけるEEPROMに記憶されたプログラムの実行部分を示すフローチャート

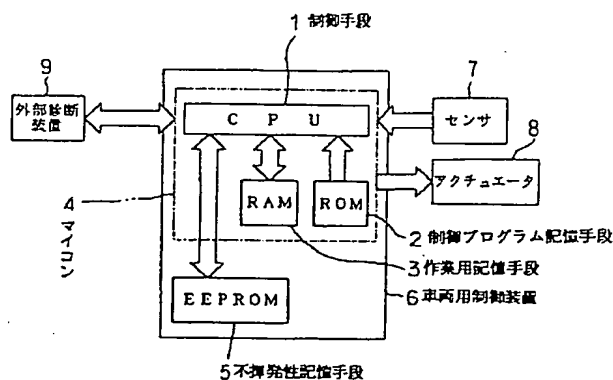
【図6】タイマ割込み処理におけるEEPROMの読出し制御部分を示すフローチャート

【符号の説明】

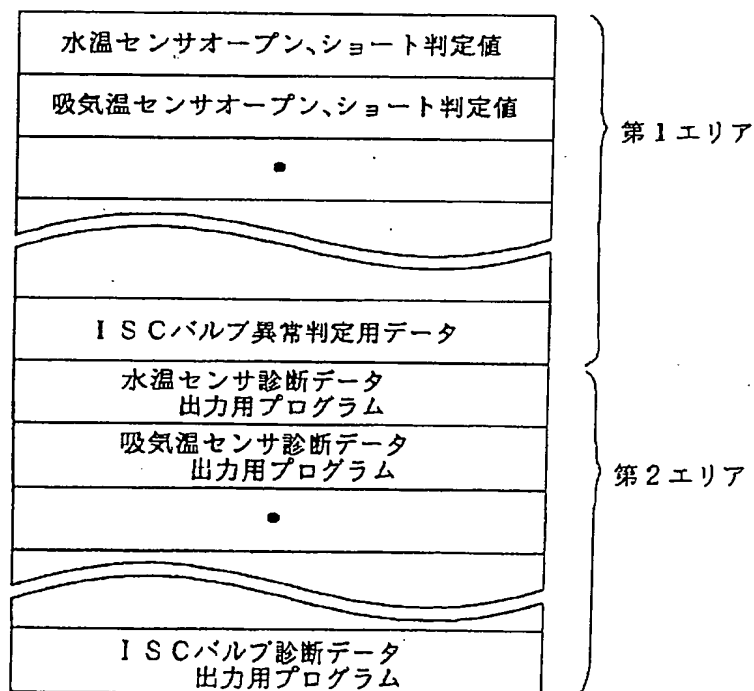
1はCPU（制御手段）、2及び10はROM（制御プログラム記憶手段）、3はRAM（作業用記憶手段）、\*

\* 5及び11はEEPROM（不揮発性記憶手段）、6及び12はエンジン制御ECU（車両用制御装置）、9は外部診断装置を示す。

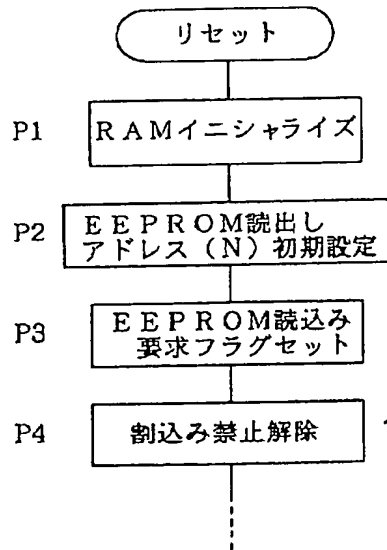
【図1】



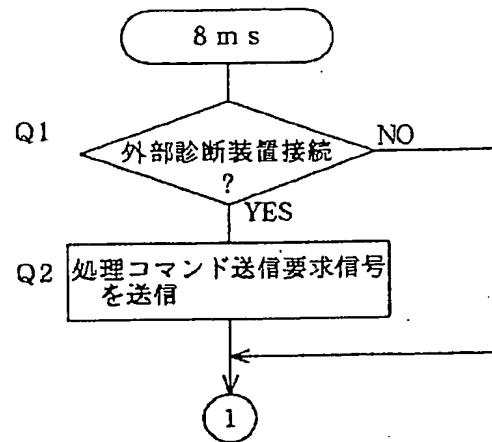
【図2】



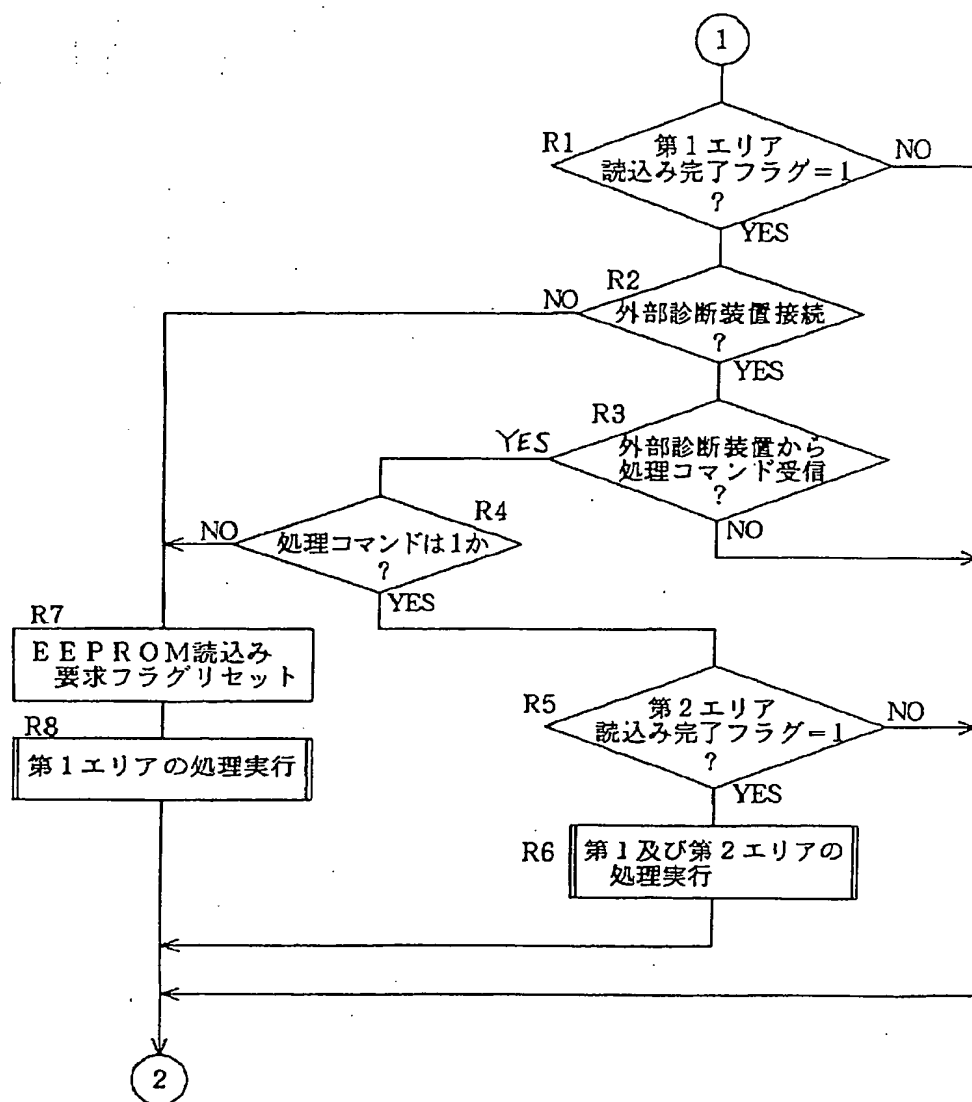
【図 3】



【図 4】



【図5】



〔図 6〕

